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(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Jerome Eldridge, et al.

Application No.: 09/929,350

Group Art Unit: 2815

Filed: August 15, 2001

Examiner: C. Chu

For: INTERNAL HYDROGEN SOURCES FOR HEAT CONDUCTIVE PACKAGING OF LOW DIELECTRIC CONSTANT SEMICONDUCTOR CHIPS, AND METHOD OF PROVIDING HYDROGEN THEREFOR

AMENDMENT

Commissioner for Patents
Washington, DC 20231

Dear Sir:

In response to the Office Action dated December 17, 2002 (Paper No. 7), please amend the above-identified U.S. patent application as follows.

Amendments to the Written Description

Page 20, line 17 through page 21, line 3 (paragraph 0075):

FIGS. 8A and B illustrate another optional embodiment ~~300~~ of the structure depicted in FIGS. 5 and 6. In this embodiment, chip ~~200~~ 300 further comprises at least one low-temperature deposition layer 355. As used herein, "low-temperature deposition" means the deposition of a layer that can be effected at a temperature that is lower than the temperature at which the metal layer is charged with hydrogen during formation of the metal hydride layer. According to this embodiment, the at least one or a plurality of thin film layers of metal hydride 245 remain uncovered by the at least one low-temperature deposition layer 355.

Page 21, line 4 through page 22, line 10 (paragraphs 0076, 0077, 0078, 0079):

FIG. 18 illustrates another optional embodiment ~~800~~ of the structure depicted in FIGS. 5 and 6. In this embodiment, chip ~~200~~ 800 further comprises a plurality of low-temperature deposition layers 855, 865, 875, 885, and 895. According to this embodiment, the at least one or a plurality of thin film layers of metal hydride 245 remain uncovered by the plurality of low-temperature deposition layers 855, 865, 875, 885, and 895.

FIGS. 9A and B illustrate optional embodiments of the structure depicted in FIGS. 5 and 6. In optional embodiment ~~400~~ depicted in FIG. 9A, the chip 400 further comprises an insulating layer 437 disposed between i) the at least one or a plurality of thin film resistors 225

and electrical contacts 235 and ii) the at least one or a plurality of thin film layers of metal hydride 245.

In optional embodiment ~~400~~ depicted in FIG. 9A, the chip 400 further comprises an insulating layer 437 disposed between i) the at least one or a plurality of thin film resistors 225 and electrical contacts 235 and ii) the at least one or a plurality of thin film layers of metal hydride 245. In this embodiment, the thickness of insulating layer 437 is at least partially determined by heat transfer considerations. That is, while insulating layer 437 must be thick enough to provide the desired degree of insulation, insulating layer 437 must also be thin enough so as to enable heat transfer from thin film resistors 225 to metal hydride 245.

In optional embodiment ~~500~~ depicted in FIG. 9B, the chip 500 further comprises an insulating layer 547 disposed above the electrical contacts 235 and the at least one or a plurality of thin film layers of metal hydride 245. In this embodiment, the thickness of insulating layer 547 is at least partially determined by mass transfer considerations. That is, insulating layer 547 must be thick enough to provide the desired degree of insulation. Insulating layer 547 must also be thin enough so as to enable diffusion of hydrogen to the hydride-forming metal during charging, and diffusion of hydrogen from metal hydride 245 during heating. In a typical embodiment, insulating layer 437 and 547 are SiO_2.

Page 24, lines 4 through 14 (paragraphs 0085 and 0086):

In an optional embodiment ~~900~~ (depicted in FIG. 19) of chip 600, chip 900 further comprises an insulating layer 945 disposed above the at least one or a plurality of thin film layers of metal hydride 625. As with chip 200, in this embodiment the insulating layer must be thin enough so as to enable diffusion of hydrogen to the hydride-forming metal during charging, and diffusion of hydrogen from metal hydride 625 during heating. In a typical embodiment, the insulating layer is SiO_2.

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In another optional embodiment ~~1600~~ (depicted in FIG. 20) of chip 600, chip 1600 further comprises at least one or a plurality of low-temperature deposition layers 1655, 1665, and 1675. According to this embodiment, the at least one or a plurality of thin film layers of metal hydride 625 remain uncovered by the at least one or a plurality of low-temperature deposition layers 1655, 1665, and 1675.

Page 29, lines 9-13 (paragraph 00102):

More specifically, FIGS. 10A-C are a flow diagram of the fabrication sequence <u>1000</u> corresponding to FIGS. 7 A-F, 8A and B, and 9A and B. The method also pertains generally to fabrication of the "non-integrated circuit-bearing" chip 100. This embodiment of the method of fabricating a hydrogen-charged semiconductor package comprises the following steps.

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Page 31, lines 3-8 (paragraph 00106):

In still another optional embodiment, the method can further comprise, before the step 1150 of enclosing the package, depositing (step 1130) and processing (step 1140) at least one or a plurality of low-temperature deposition layers ~~355~~ 350 (FIG. 8~~B~~A), wherein the at least one or a plurality of processed thin film layers of metal hydride 245 (FIG. 7F) remain uncovered by the at least one or a plurality of low-temperature deposition layers 355 (FIG. 8B).

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Page 31, lines 9-17 (paragraph 00107):

FIGS. 16A-F illustrate another embodiment of the fabrication of the structure depicted in FIGS. 5 and 6. FIGS. 17A-C are a flow diagram of the fabrication sequence 1400 corresponding to FIGS. 16A-F. In this embodiment, the sequence of steps employed is different from that associated with the embodiment depicted in FIGS. 10A-C, but the resulting structure 700 is analogous to chip 200. According to this optional embodiment, the layer of hydride-forming metal is deposited and processed before the deposition of the layer of electrical contact metal. Use of this optional fabrication sequence might be dictated by either a materials of construction consideration (e.g., the metal employed for the electrical contacts) or by the etching process that is employed.

Page 33, line 15, through page 34, line 2 (paragraph 00113):

FIGS. 14A and B are a flow diagram of the fabrication sequence 1200 corresponding to FIGS. 13A-D. This sequence is employed to fabricate the chip 600 for use with the external source of heat. According to this embodiment, after preparing a substrate 610 (FIG. 13A)(step 1210), a layer of hydride-forming metal 620 (FIG. 13A) is deposited upon substrate 610 (step 1230). The layer of hydride-forming metal 620 is photo-processed to form one or a plurality of thin film layers of hydride-forming metal 625 (FIG. 13B)(step 1240). The one or a plurality of thin film layers of hydride-forming metal 625 are then charged with hydrogen (step 1260) to form one or a plurality of thin film layers of metal hydride, and the charged package is enclosed.

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Page 34, lines 9-13 (paragraph 00115):

In still another optional embodiment, the method can further comprise, before the step 1290 of enclosing the package, depositing (step 1270) and photo-processing (step 1280) one or a plurality of low-temperature deposition layers ~~635~~ 630 (FIG. 13~~D~~C), wherein the one or a plurality of thin film layers of metal hydride 625 (FIG. 12) remain uncovered by the one or a plurality of processed low-temperature deposition layers 635 (FIG. 13D).

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Page 34, lines 14-18 (paragraph 00116):

FIG. 15 is a schematic view of the method of heating with an external source of heat 670 a package containing the chip 600 depicted in FIG. 12. As explained above, the source of heat can be laser radiation or a similar intense energy source that is communicated to chip 600

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through a "window" in the package. The external heating method can be desirable, for example, when enclosure ~~670~~ 660 is a transparent cover plate.